

### **REMARKS**

The present application includes claims 1-70 of which 1-10, 23-58 and 60-63 have been withdrawn from consideration in response to a restriction requirement mailed December 19, 2005. In the Office action mailed on April 7, 2006, the Examiner considered claims 11-22, 59 and 64-70. Claims 11 and 13 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,299,648 to Ciszek *et al* ("Ciszek"); claim 11 was rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,334,948 to Berkman *et al* ("Berkman"); claims 11, 12, 16, 19 and 22 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,861,416 to Morrison ("Morrison"); claims 13-15, 18, 20-21 and 64-70 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Morrison in view of International Patent Publication No. 01/04388 to Janoch *et al* ("Janoch"); claim 17 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Morrison in view of Berkman; and claim 59 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Morrison in view of U.S. Patent No. 4,402,786 to Little ("Little").

Applicant has amended claims 68 and 69. Support for these amendments can be found, for example, at pages 2 and 17 of the originally-filed specification. Applicant respectfully submits no new matter has been introduced by this amendment.

In view of the amendments to the claims together with the following remarks, Applicant respectfully requests reconsideration and withdrawal of all grounds of rejection.

#### **A. Rejection of Claims 11, 12, 13, 16, 19 and 22 Under 35 U.S.C. § 102(b)**

Independent claim 11 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Ciszek, Berkman, and Morrison. Dependent claim 13 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Ciszek and dependent claims 12, 16, 19, and 22 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Morrison. For a claim to be anticipated under 35 U.S.C. § 102(b), the cited reference must teach or suggest each and every limitation in the claim. Applicant respectfully submits that none of Ciszek, Berkman, and Morrison, for the reasons discussed below, disclose every claim element of the claimed invention.

Applicant's independent claim 11 recites an apparatus for forming a crystalline ribbon. The apparatus includes a mesa crucible having *edges defining a boundary of a top surface* of

the mesa crucible, with the mesa crucible retaining edges of a *melt by capillary attachment to the edges of the mesa crucible* (emphasis added). Applicant respectfully submits that none of Ciszek, Berkman, and Morrison teaches or suggests a mesa crucible that retains edges of a melt by capillary attachment to the edges of the mesa crucible, the edges of the mesa crucible defining a boundary of a top surface of the mesa crucible.

Specifically, Ciszek discloses an apparatus where a shaping die is utilized to form a pair of raised menisci (caused by surface tension) of melt sufficient to provide an area into which a seed ribbon can be displaced for contact with the melt. (See, for example, col. 4, ln. 1-5 of Ciszek). Similarly, Berkman discloses an apparatus utilizing a die member, located in the crucible, that allow the melt to travel by capillary action through passage columns. (See, for example, col. 3, ln. 55-68; col. 3, ln. 38-46 of Berkman). Likewise, Morrison discloses an apparatus utilizing extended filament guides that allows for more melt to be disposed within a container and also provides minimal contact between the silicon melt and the filament. (See, for example, col. 1, ln. 33-38; col. 1, ln. 64-68 of Morrison).

Different from the three cited references, Applicant's claimed apparatus does not utilize a shaping die, a die member, or extended filament guides. Instead, Applicant's independent claim 11 recites the use of capillary attachment between the edge of the top surface of the mesa crucible and the melt to retain the melt, a concept completely missing from the cited references. The advantage of Applicant's claimed apparatus is that the capillary action causes the ribbon to grow flat due to the concave down shape of the melt, even when the size of the crucible is significantly reduced by bringing the walls of the crucible closer to the area in which the ribbon grows. (See, for example, pg. 2 ln. 28 to pg. 3 ln. 5 of the present application).

Referring to Fig. 1 of Ciszek, it is clear that the melt never comes into contact with the edges of the container (1), but rather comes in contact with the shaping die (9), to form raised menisci, creating the area into which a seed ribbon can be disposed. Thus, Ciszek fails to teach or suggest a mesa crucible that retains edges of a melt by capillary attachment to the edges of the mesa crucible.

Similarly, in Fig. 1 of Berkman, the melt does not come into contact with the top edges of the crucible (12), but instead, a die member (14) is used to define the area in which the ribbon grows. Therefore, Berkman fails to teach Applicant's claimed apparatus including a mesa

crucible that retains edges of a melt by capillary attachment to the edges of the mesa crucible.

Likewise, Fig. 2 of Morrison shows that the melt does not come into contact with the edges of Morrison's container (32), but rather, extended filament guides (42,44) are used to define the area in which the ribbon grows. Accordingly, Morrison also fails to disclose a mesa crucible that retains edges of a melt by capillary attachment to the edges of the mesa crucible.

Since Ciszek, Berkman, and Morrison do not teach or suggest an apparatus including a mesa crucible retaining edges of a melt by capillary attachment to the edges of the mesa crucible as claimed by Applicant, the undersigned respectfully submits that at least this element of Applicant's claim is missing from the cited references. Accordingly, Applicant submits that claim 11 is patentable.

Claims 12-16 and 18-22 depend from independent claim 11 and are patentable over Ciszek, Berkman, and Morrison at least for the same reason claim 11 is patentable.

#### **B. Rejection of Claims 13-15, 17, 18, 20-21, 59 and 64-70 Under 35 U.S.C. § 103(a)**

Claims 13-15, 18, 20-21 and 64-70 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Morrison in view of Janoch. To establish a prima facie case of obviousness 1) there must be a motivation to combine the references, 2) there must be a reasonable expectation of success, and 3) the combination must teach or suggest all of the elements of Applicants' claims. Applicant respectfully submits that neither Morrison nor Janoch, either alone or combined by the Examiner, teach or suggest each and every element of Applicant's independent claim 11, 64, and 68-70.

As discussed above, Applicant's independent claim 11 recites an apparatus for forming a crystalline ribbon. The apparatus includes a mesa crucible having edges defining a boundary of a top surface of the mesa crucible, with the mesa crucible retaining edges of a melt by capillary attachment to the edges of the mesa crucible. Neither reference teaches or suggests a mesa crucible retaining edges of a melt by capillary attachment to the edges of the mesa crucible. As previously explained, Morrison does not utilize capillary action between the melt and the crucible, but instead utilizes extended filament guides so that more molten can be dispensed in the container and also provides minimal contact between the silicon melt and the filament. Similarly, Fig. 2 of Janoch shows that the melt does not come into contact with the edges of the

crucible (32). Thus, Janoch also fails to teach or suggest Applicant's claimed crucible that retains edges of a melt by capillary attachment to the edges of a mesa crucible. Since neither Morrison nor Janoch teach or suggest an apparatus where the edges of the melt are retained by capillary attachment to the edges of the mesa crucible, Applicant respectfully submits that the combination of Morrison and Janoch fails to establish a prima facie case of obviousness with respect to independent claim 11.

Claims 13-15, 18, and 20-21 depend directly or indirectly from claim 11. Applicant submits that claims 13-15, 18, and 20-21 are patentable in view of the cited references for at least the same reasons claim 11 is patentable. Thus, Applicant also requests that the Examiner withdraw the 35 U.S.C. § 103 rejections against claims 13-15, 18, and 20-21.

Applicant's independent claim 64 recites an apparatus for replenishing a melt on a mesa crucible, and comprising means for distributing a source material onto a mesa crucible, thereby reducing the heat load required to melt the source material.

As defined by Applicant on page 6 of the originally-filed specifications, a mesa crucible is a "crucible which has the general form of a mesa – a generally flat top surface and steep side walls." As seen in Fig. 2, Morrison fails to teach or suggest the use of a mesa crucible, but instead utilizes a crucible with vertical or non-steep walls (32). Janoch also fails to describe a replenishing system for a mesa crucible. Instead, Janoch describes a replenishing system for a crucible which is merely defined as an object that "holds a melt of a semiconductor material." (See, for example, pg. 3, ln. 12-13 and Fig. 2 of Janoch).

Moreover, Applicant's replenishment system distributes the BB's along a length of the mesa, thereby diminishing the possibility that the BB's will fall on top of one another, which in turn reduces the heat load required to melt the source material. (See, for example, pg. 3, ln 12-13 and pg. 30, ln. 6-12 of Applicant's specification). Referring to Fig 11. of Janoch, the source material is introduced into the crucible at a single point. (See, for example, pg. 17, ln. 10-14 of Janoch). Therefore, the source material could potentially fall on top of one another and the heat load required to melt the source material will not be reduced as claimed by Applicant's apparatus.

Since neither Morrison nor Janoch teach or suggest a replenishing system that reduces the overheat needed to melt the source material in a mesa crucible, Applicant respectfully submits that the combination of Morrison and Janoch fails to establish a prima facie case of obviousness.

Claims 65-67 depend directly or indirectly from claim 64. Applicant submits that claims 65-67 are patentable in view of the cited references for at least the same reasons claim 64 is patentable. Thus, Applicant also requests that the Examiner withdraw the 35 U.S.C. § 103 rejections against claims 65-67.

Applicant's amended independent claim 68 recites an apparatus for forming a crystalline ribbon, and the apparatus comprising a mesa crucible that retains edges of a melt by capillary attachment to the edges of the mesa crucible, wherein at least a portion of the boundary profile is concave downward. Similarly, amended independent claim 69 recites an apparatus for forming a crystalline ribbon, and the apparatus comprising a mesa crucible that retains edges of a melt by capillary attachment to the edges of the mesa crucible, thereby forming an inflection point in at least a portion of a cross-sectional boundary profile of the melt. As described above, neither Morrison nor Janoch, independently or together, teach or suggest a mesa crucible that utilizes capillary attachment between the edges of a mesa crucible and the melt.

Since neither Morrison nor Janoch teach or suggest a mesa crucible system that retains edges of a melt by capillary attachment to the edges of the mesa crucible, Applicant respectfully submits that the combination of Morrison and Janoch fails to establish a prima facie case of obviousness.

Applicant's independent claim 70 recites an apparatus for forming a crystalline ribbon, a crucible for retaining a melt having a boundary profile, wherein a substantial portion of the melt is above the edges of the crucible. As discussed previously, Morrison lacks these characteristics. That is, since Morrison's melt never reaches the edge of the wall of the container, no portion of Morrison's melt could ever reach the point of being above the edge of the crucible, as claimed by Applicant. Similarly, observing fig. 2 of Janoch, it is clear that Janoch's melt never reaches the edge of the wall of the crucible (32), and therefore Janoch's melt does not reach the point of being above the edge of the crucible.

Since neither Morrison nor Janoch teach or suggest an apparatus wherein a substantial portion of the melt is above the edges of the crucible, Applicant respectfully submits that the combination of Morrison and Janoch fails to establish a prima facie case of obviousness.

Claim 17 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Morrison in view of Berkman. As described above, neither Morrison nor Berkman teach or suggest a mesa crucible that retains edges of a melt by capillary attachment to the edges of the mesa crucible, as recited in independent claim 11. Claim 17 depends from claim 11. Accordingly, Applicant submits that claim 17 is patentable, for at least all of the reasons claim 11 is patentable in view of Morrison and/or Berkman.

Claims 59 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Morrison in view of Little. Applicant's independent claim 59 recites an apparatus for controlling the temperature of a mesa crucible while forming a crystalline ribbon, the apparatus comprising a mesa crucible disposed within a furnace; an insulator comprising movable elements disposed along the mesa crucible; and means for moving the moveable elements of the insulator relative to the mesa crucible to create controlled heat leaks. As described above, Morrison fails to teach or suggest Applicant's claimed mesa crucible. The combination of Morrison with Little fails to cure this deficiency because Little also fails to teach or suggest a mesa crucible. Specifically, Fig. 2 of Little shows the use of a crucible (38) that has vertical non-steep walls. As a result, Little fails to teach or suggest the use of a mesa crucible.

Since neither Morrison nor Little teach or suggest an apparatus wherein a mesa crucible is used, Applicant respectfully submits that the combination of Morrison and Little fails to establish a prima facie case of obviousness. Thus, Applicant request reconsideration and removal of these 35 U.S.C. § 103(a) rejection.

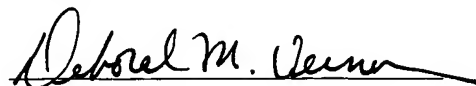
**CONCLUSION**

Applicant respectfully request consideration and allowance of claims 11-22, 59 and 64-70. The Examiner is respectfully requested to telephone the undersigned at (617) 526-9836 to discuss any further issues in this matter.

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Respectfully submitted,

A handwritten signature in black ink, appearing to read "Deborah M. Vernon", with a long horizontal flourish extending to the right.

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